

# Acquisition of a Hadland High Speed Camera System

By:

R.C. Zowarka  
C. Morgan

Technical Report

DURIP98/99  
Air Force Grant #F49620-98-1-0226

RF - 195

Center for Electromechanics  
The University of Texas at Austin  
PRC, Mail Code R7000  
Austin, TX 78712  
(512) 471-4496

April 13, 2000

20010404 119

## REPORT DOCUMENTATION PAGE

AFRL-SR-BL-TR-01-

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering the data, reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Project (0704-0188).

0208

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE APRIL 2000	3. REPORT TYPE AND DATES COVERED FINAL TECHNICAL REPORT 1 Mar 98 - 31 May 99
4. TITLE AND SUBTITLE (DURIP98/99) ACQUISITION OF A HADLAND HIGH SPEED CAMERA SYSTEM			5. FUNDING NUMBERS F49620-98-1-0226  3484/US 61103D
6. AUTHOR(S) R.C. ZOWARKA, AND C. MORGAN			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) UNIVERSITY OF TEXAS AT AUSTIN CENTER FOR ELECTROMECHANICS PRC, MAIL CODE R7000 AUSTIN, TX 78712			8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AIR FORCE OFFICE OF SCIENTIFIC RESEARCH 801 N. RANDOLPH STREET, ROOM 732 ARLINGTON, VA 22203-1977			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE, DISTRIBUTION IS UNLIMITED			12b. DISTRIBUTION CODE  AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 19012 DISTRIBUTION IS UNLIMITED.
13. ABSTRACT (Maximum 200 words) The Imacon 468 is an Ultra High Speed Framing and Streak Camera with framing rates from 100 fps to 100 million fps and exposure times from 1 millisecond down to 10 nanoseconds. It has independent exposures, interframe times and gain adjustments on each frame which makes it the most versatile system available. It is the highest resolution Ultra High Speed framing camera with 576 x 385 pixels per frame. The gain is adjustable from unity to approximately 7000 X in seven steps. The Imacon 468 can be fitted with 4, 6 or 8 frames (odd number by special request).			
14. SUBJECT TERMS			15. NUMBER OF PAGES 5
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT U	18. SECURITY CLASSIFICATION OF THIS PAGE U	19. SECURITY CLASSIFICATION OF ABSTRACT U	20. LIMITATION OF ABSTRACT

## **IMACON 468**

### General...

The Imacon 468 is an Ultra High Speed Framing and Streak Camera with framing rates from 100 fps to 100 million fps and exposure times from 1 millisecond down to 10 nanoseconds. It has independent exposures, interframe times and gain adjustments on each frame which makes it the most versatile system available. It is the highest resolution Ultra High Speed framing camera with 576 x 385 pixels per frame. The gain is adjustable from unity to approximately 7000 X in seven steps. The Imacon 468 can be fitted with 4, 6 or 8 frames (odd number by special request).

### Imagers...

The imagers are 4, 6 or 8 Scientific Grade Intensified CCD Cameras fitted to a pyramid type beam splitter. The CCD's are 576 x 385 x 8 bit and run as full frame slow scan readouts to give maximum resolution, sensitivity and dynamics range. The intensifiers are GEN II type with S25 photocathodes which are fiber optic coupled to the CCD for maximum coupling efficiency.

### Timing...

All timing sequencers are built into the camera head to drive the CCD's and the intensifiers. The camera has 9 channels of delay generators which have 10 ns resolution. The ninth channel is for generating monitor pulses which can be used for other synchronization or recording. Each 8 frame channels delay generator also has a programmable pre pulse which can be programmed to output a drive pulse to a flash lamp or other light

source prior to the frame time in order for the light to be up to full brightness when the image is taken. A flash lamp drive cable is included with the system.

#### Triggers...

The camera requires a  $\pm 5$  V TTL trigger level and has a  $\pm 25$  V sensitivity selector for noise rejection or can be triggered internally from the software commands, or from a Make or Break contact switch. The trigger circuit is over voltage protected to  $\pm 50$  V.

#### Control...

The camera head has a built in touch screen focus monitor for easy setup in the field. All operating parameters are programmed from the Dell Pentium 166 computer and Imacon 468 Software package that is included with the system via a 10 meter Fiber Optic cable included with the system (100 meter optional). Fiber Optic coupling ensure proper communication even in high electrical noise environments. Programming of the system is extremely easy and can be done either pictorially or numerically using the Setup page of the software. Previously stored setup files can be loaded and the camera programmed from them or a previously taken image can be loaded and the tagged setup data can be loaded to the camera for repeatable operation. After the event occurs and the images are captured they are held in frame buffers in the camera and sent to the computer via the fiber optic cable in 0.5 seconds, and the images are displayed on the display monitor for viewing. The images can then be saved as TIF format files, and all setup data are stored with the image.

### Software...

The Imacon 468 software is run under Windows 95, is extremely easy to use, and has many common data reduction functions built in, including velocity, angle, distance, trace, animation and many more. There is a full image processing package included as well, including binary functions, filters, contrast and gamma adjustments, pseudo color and CCD Characterization. All file management functions run under Windows 95 are incorporated, as well as all print functions for fast and easy hard copy printing.

### Image Storage...

Images are stored in TIF format for easy transfer to other work stations. Each frame is about 225 KB thus and 8 frame sequence is 1.8 MB and will not fit on a 1.44 floppy disk. The software has a file compression routing included, and most images will PKZip compress to about 1.3 MB.

It. No.	Description
01	Imacon 468/6 Camera, S/N 145, P/N 083-100-06 Including: 10 M Fiber Optic Cable, Control Computer S/N CM5FF, 15" Monitor S/N 4056450, 17" Monitor S/N 1231527, Control/Image Software, PC/Camera Interface Card, Power Cable, Storage Case
02	Epson Stylus 800 Printer, S/N 3HR 1446568, P/N EPS 800
03	500 mm Nikon Lens f1.4, S/N 5811464, P/N 50/1.4
04	Extension Tube 100mm, P/N 100 EXT
05	105mm Nikon Lens f1.8, S/N 1042491
06	Extension Tube 210mm, P/N 210EXT
07	High Power Flash Lamp, P/N 600/1.5
08	Cross Slide Attachment for Pillar Stand, P/N Cross
09	Installation P/N INST
10	665-15, Extension Tubes for Nikon Mount Lenses, EXT-006
11	Interface Module Transfer Box #IM-001 Multi
12	655-20 High Power Flash Unit 2050 Module Head, 2050 MH Modular Unit for 2-2.5 kw Generation of High Power Flash Unit--Modified and to be used in conjunction with Digital High Speed Camera to be used in conjunction with 20/25 Flash Head #7002-363
13	655-39 High Power Flash Unit 2050, 7002-363, 26US Xenon Flash Unit for High Speed Digital System

<b>It. No.</b>	<b>Description</b>
14	655-20 135 Nikon F/2.0 Lens, Nikon 00135
15	180 MM Nikon F/2.8 Lens, Nikon 00180
16	2050 Xeon Flash Ext., 2050-FL-Ext. Extension
17	655-15 High Power Flash Unit #600-1.5, Photogenic Flash Unit. 1.2 MS Duration
18	Interface Module for Photogenic Flash IM- 600-1.5
19	920-68 IMACON 468 Training Course (Full Instructional Training Class to be Performed at UT/CEM for 5-6 persons) Classroom instruction and hands on high speed tech- niques will be provided, including course manuals on the IMACON 468. Dates set to be 24-28 May, 1999, with a tentative backup date of 7-11 June or 14-19 June, 1999. All inclusive costs added.
20	920-47, Norton Anti-Virus 5.0 #S55663
21	480-15, 0 32MB SDRAM PC 100 #RAM464S100
22	480-61, 1 Maxtor 11.5 Gigabyte UDMA harddrive #IDEMAX11.5
23	920-47, Delta Graph: 4.5 for Mac

# Acquisition of a Hadland High Speed Camera System

By:

R.C. Zowarka  
C. Morgan

Financial Report

DURIP98/99  
Air Force Grant #F49620-98-1-0226

RF - 195

Center for Electromechanics  
The University of Texas at Austin  
PRC, Mail Code R7000  
Austin, TX 78712  
(512) 471-4496

April 13, 2000



It. No.	Description	Amount
01	Imacon 468/6 Camera, S/N 145, P/N 083-100-06 Including: 10 M Fiber Optic Cable, Control Computer S/N CM5FF, 15" Monitor S/N 4056450, 17" Monitor S/N 1231527, Control/Image Software, PC/Camera Interface Card, Power Cable, Storage Case	\$249,485.00
02	Epson Stylus 800 Printer, S/N 3HR 1446568, P/N EPS 800	552.00
03	500 mm Nikon Lens f1.4, S/N 5811464, P/N 50/1.4	780.16
04	Extension Tube 100mm, P/N 100 EXT	598.00
05	105mm Nikon Lens f1.8, S/N 1042491	1,427.84
06	Extension Tube 210mm, P/N 210EXT	598.00
07	High Power Flash Lamp, P/N 600/1.5	1,380.00
08	Cross Slide Attachment for Pillar Stand, P/N Cross	b/o
09	Installation P/N INST	5,184.00
10	665-15, Extension Tubes for Nikon Mount Lenses, EXT-006 (2)	1,200.00
11	Interface Module Transfer Box #IM-001 Multi	600.00
12	655-20 High Power Flash Unit 2050 Module Head, 2050 MH Modular Unit for 2-2.5 kw Generation of High Power Flash Unit-- Modified and to be used in conjunction with Digital High Speed Camera to be used in conjunction with 20/25 Flash Head #7002-363	3,200.00
13	655-39 High Power Flash Unit 2050, 7002-363, 26US Xenon Flash Unit for High Speed Digital System	5,000.00

<b>It. No.</b>	<b>Description</b>	<b>Amount</b>
14	655-20 135 Nikon F/2.0 Lens, Nikon 00135	2,387.00
15	180 MM Nikon F/2.8 Lens, Nikon 00180	2,431.00
16	2050 Xeon Flash Ext., 2050-FL-Ext. Extension	182.00
17	655-15 High Power Flash Unit #600-1.5, Photogenic Flash Unit. 1.2 MS Duration (3)	4,800.00
18	Interface Module for Photogenic Flash IM- 600-1.5	200.00
19	920-68 IMACON 468 Training Course (Full Instructional Training Class to be Performed at UT/CEM for 5-6 persons) Classroom instruction and hands on high speed tech- niques will be provided, including course manuals on the IMACON 468. Dates set to be 24-28 May, 1999, with a tentative backup date of 7-11 June or 14-19 June, 1999. All inclusive costs added.	5,000.00
20	920-47, Norton Anti-Virus 5.0 #S55663	29.49
21	480-15, 0 32MB SDRAM PC 100 #RAM464S100	55.00
22	480-61, 1 Maxtor 11.5 Gigabyte UDMA harddrive #IDEMAX11.5	185.00
23	920-47, Delta Graph: 4.5 for Mac	214.00
24	Freight Charges	33.75
	<b>TOTAL:</b>	<b>\$285.521.74</b>